

NEC Corporation

1G Intelligent L2 and L3 Switches and 10G Intelligent L3 Switch

Functionality Certification and Cooperative Interoperability Evaluation



Test Summary

Premise: *Heterogeneous, multivendor networks are the rule rather than the exception. IT managers who deploy a variety of Fast Ethernet, Gigabit Ethernet and 10GbE switching devices in their networks need guaranteed interoperability of these switches in order to maintain a functional network.*

NEC Corporation and BLADE Network Technologies (BLADE) commissioned The Tolly Group to evaluate three of their enterprise-class LAN switches for interoperability with other switch brands.

Tolly Group engineers evaluated the NEC 1G Intelligent L2 Switch, NEC 1G Intelligent L3 Switch & NEC 10G Intelligent L3 Switch against more than a dozen tests with switches from 3Com, Cisco Systems, Inc., Enterasys Networks, Inc., Force10 Networks, Inc., Hewlett-Packard Co, IBM Corporation, and Foundry Networks, Inc.

Engineers subjected the NEC switches to advanced Layer 2 and Layer 3 tests, including support for auto-negotiation, 802.1p/Q VLAN tag propagation, 10GbE LAN PHY Support, 802.3ad LACP support, Rapid Spanning Tree Protocol support, Multiple Spanning Tree Protocol support 802.1s, RIPv2, RIPv3, OSPFv2, OSPFv3 support, BGP4, Virtual Router Redundancy Protocol (VRRP) and Jumbo Frames.

Tests were conducted in August 2008 in Santa Clara, CA at Ixia's iSimCity lab facility.

Test Highlights

- ▶ Earns 16 Switch Interoperability certifications for Layer 2 and Layer 3 advanced LAN functions
- ▶ Achieves broad Layer 2 and Layer 3 interoperability with 19 switches from eight vendors
- ▶ Interoperates with other devices tested when supporting 10GbE LAN PHY interface, 802.1p/Q VLAN tags, link aggregation, Multiple Spanning Tree, VRRP, OSPF protocols, and more

NEC 1G Intelligent L2 Switch, NEC 1G Intelligent L3 Switch & NEC 10G Intelligent L3 Switch Interoperability Certified Features/Functions

Certification	Result
Auto-Negotiation	
802.1p/Q VLAN Tag Propagation	
Jumbo Frame support	
Link Aggregation Control Protocol (LACP)	
10-GbE LAN PHY support	
Rapid Spanning Tree Protocol (RSTP)	
Multiple Spanning Tree Protocol (MSTP)	
Source: The Tolly Group, August 2008	

Figure 1

Executive Summary

NEC switches demonstrated broad interoperability with 19 other switches for advanced LAN and routing functions at Layer 2 and Layer 3.

In a world of ever-evolving standards and tight budgets, network managers searching for new equipment need to know that the switches they purchase are interoperable with their current infrastructures. It is important for managers to

know which devices can maintain their interoperability with different standardized functions.

Engineers tested 20 switches from eight vendors to determine the various levels of interoperability offered.

In Layer 2 interoperability tests, the three NEC switches the 1G Intelligent L2 Switch, 1G Intelligent L3 & 10G Intelligent L3 switches consistently demonstrated interoperability with switches from 3Com, Cisco Systems, Inc., Force10, Inc., IBM, Foundry, Hewlett-Packard Co. and Enterasys Networks, Inc.

(The IBM & HP switch modules were manufactured by BLADE Network Technologies.)

In Layer 3 interoperability tests, the NEC switches achieved broad interoperability with a 3Com Switch 4800G, seven Enterasys Networks models tested, a Cisco Catalyst 6500, one IBM, two HP, and four Foundry switches.

Layer 2 Functions

10/100/1000 Auto-negotiation

The NEC switches interoperated with all of the switches tested. Devices earning this certification have demonstrated the ability to establish the highest available speed and duplex settings in all possible vendor combinations.

Layer 2 Interoperability Certifications Awarded to NEC 1G Intelligent L2 Switch, NEC 1G Intelligent L3 Switch and NEC 10G Intelligent L3 Switch

Certification	10/100/1000 Auto-Negotiation	802.1p/Q VLAN Tag Propagation	Jumbo Frame support	Link Aggregation (LACP) support	10G LAN PHY	Rapid Spanning Tree Protocol Support	Multiple Spanning Tree Protocol Support
3Com® Switch 4800G 24-Port	✓	✓	✓	N/A	N/A	✓	N/A
Cisco Catalyst 6506-E	✓	✓	✓	✓	N/A	✓	✓
Enterasys SecureStack A2H124-48	✓	N/A	N/A	N/A	N/A	✓	N/A
Enterasys SecureStack B3G124-24	✓	N/A	N/A	N/A	N/A	✓	N/A
Enterasys SecureStack C2K122-24	✓	✓	✓	N/A	N/A	✓	N/A
Enterasys G3G124-24P w/G3K-4XFP	✓	✓	✓	✓	N/A	✓	✓
Enterasys D2G124-12	✓	N/A	N/A	N/A	N/A	✓	N/A
Enterasys Matrix-N 7G4282-49 w/7K-2XFP	✓	✓	✓	N/A	N/A	✓	N/A
Enterasys Matrix X4 Secure Core Router	✓	✓	✓	N/A	N/A	✓	N/A
Force10 C300 Resilient Switch	✓	✓	✓	✓	N/A	✓	✓
Nortel 1/10Gb Uplink Ethernet Switch Module for IBM	✓	✓	✓	N/A	N/A	✓	N/A
HP 1:10Gb Ethernet Blade Switch	✓	✓	✓	N/A	N/A	✓	N/A
HP 10GB Ethernet BL-C switch	N/A	N/A	✓	N/A	N/A	N/A	N/A
Foundry FastIron GS 624P-PoE	✓	✓	✓	N/A	N/A	✓	N/A
Foundry FastIron LS 624	✓	✓	✓	N/A	N/A	✓	N/A
Foundry FastIron Edge Series X 624E+2XG-PREM6	✓	✓	✓	N/A	N/A	✓	N/A
Foundry BigIron RX-4-AC	✓	✓	✓	N/A	N/A	✓	N/A

PASS
 PASS
 PASS
 N/S= Not Supported N/A= Not Tested

Source: The Tolly Group, August 2008

Figure 2

802.1P/Q VLAN Tag Propagation

The NEC switches interoperated with all of the switches tested. Devices earning this certification have demonstrated the ability to maintain and recognize 802.1p/Q tags across all vendor combinations tested.

Jumbo Frame Sup-

port

The NEC switches interoperated with every switch tested. Devices earning this certification have demonstrated the ability to transmit Jumbo Frames (9K bytes) across all possible vendor combinations.

10GbE LAN PHY

This verifies that the NEC switches tested have the ability to transmit data between

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- 1G Intelligent L2 Switch
- 1G Intelligent L3 Switch
- 10G Intelligent L3 Switch



Layer 2/3 Feature Interoperability

Product Specifications

Vendor-supplied information not necessarily verified by The Tolly Group

NEC Corporation

1G Intelligent L2 Switch

- Five Gigabit RJ-45 uplink ports
- 16 internal server downlinks
- Two internal cross-connects in a single low cost blade switch
- 100% line rate—no dropped packets
- Standards-based Layer 2 features including:
 - VLANs
 - Spanning Tree
 - Rapid Spanning Tree
 - Multiple Spanning Tree
 - Uplink Failure Detection (4 pairs)
 - 2048 ARP entries
- Proven Interoperability in Cisco networks
- Supporting SmartPanel operating mode — Simple and effective to configure and manage the switch.
- High-Availability
- Security
- Low Power Consumption: 25W
- Up to 10x savings over external switches

NEC Corporation

1G Intelligent L3 Switch

- Five Gigabit RJ-45 uplink ports
- Four optional external 1000SX fiber Uplinks
- 16 internal downlinks
- Two internal cross-connects in a single low cost blade switch
- 100% line rate—no dropped packets
- Standards-based Layer 2 and Layer 3 features including:
 - VLANs
 - Spanning Tree
 - Rapid Spanning Tree
 - Multiple Spanning Tree
 - Uplink Failure Detection (4 pairs)
 - IP forwarding
 - 256 IP interfaces
 - 2048 ARP entries
 - Global default route
 - Static routing support with 128 routing table entries
 - Dynamic routing support with entries in routing table (512 entries)
 - Dynamic Routing protocols (OSPF, RIPv1/v2)
 - VRRP
- Proven Interoperability in Cisco networks
- High-Availability
- Security
- Low Power Consumption: 30W
- Up to 10x savings over external switches

NEC Corporation

10G Intelligent L3 Switch

- Two-slot width
- 4 External 10Gb XFP ports
- 16 internal 10G downlink ports
- 256Mb SDRAM
- 64Mb Flash memory
- Full line rate available—no dropped packets under normal condition
- Standards-based Layer 2 and Layer 3 features including:
 - VLANs
 - Spanning Tree
 - Rapid Spanning Tree
 - Multiple Spanning Tree
 - Uplink Failure Detection (4 Pairs)
 - IP forwarding
 - 250 IP interfaces
 - 2048 ARP entries
 - Global default route
 - Static routing support with 128 routing table entries
 - Dynamic routing support with entries in routing table (512 entries)
 - Dynamic Routing protocols (OSPF, RIPv1/v2)
 - VRRP
- Proven Interoperability in Cisco networks
- High-Availability
- Security
- Low Power Consumption: 65W

For more information contact:

BLADE Network Technologies

<http://www.bladenetwork.net/nec>

multiple vendors' 10-Gigabit Ethernet interfaces. In this test, the NEC switch successfully interoperated with almost all of the switches, except for models that do not offer the 10GbE support.

Link Aggregation Control Protocol (LACP)

This test verifies a device's ability to trunk ports across multiple vendor combinations using IEEE 802.1s Link Aggregation Protocol (LACP). For this Layer 2 test, NEC switches achieved interoperability with all 18 other participating switches.

Rapid Spanning Tree Protocol (RSTP)

Devices earning this certification have demonstrated the ability to detect a failure of the Layer 2 spanning tree via the IEEE 802.1w Rapid Spanning Tree protocol and to establish a new Layer 2 "tree."

In networks where multiple data paths exist, this approach provides a quicker re-establishment of traffic paths and dramatically reduces user downtime when compared with the recovery mechanism of traditional 802.1D spanning tree bridges/switches.

For this test, the NEC switches tested demonstrated interoperability

with all switches from 3Com, Cisco, Enterasys, Force10, HP, IBM, and Foundry.

Multiple Spanning Tree Protocol (802.1s)

This verifies that the NEC switches tested implement IEEE 802.1s Multiple Spanning Tree instances on a switch port to selectively allow or block multiple VLANs., without blocking the entire traffic traversing the port.

Layer 3 Functions

RIPv2

This test verifies that the two NEC switches supporting Layer 3 functions (NEC 1G Intelligent L3 Switch and NEC 10G Intelligent L3 Switch) exchange IPv4

routing table information via RIP v2 protocols. The NEC switches interoperated with switches from 3Com, Cisco, Enterasys, Force10, IBM, HP and Foundry.

OSPFv2

Tolly Group engineers verified that the NEC switches exchanged routing table information via OSPFv2 with other brand switches.

Tests show that the two NEC switches share OSPF routing table data with participating switches from 3Com, Cisco, Enterasys, Force10, HP, IBM and Foundry.

Layer 3 Interoperability Certifications Awarded to NEC 1G Intelligent L3 Switch and NEC 10G Intelligent L3 Switch

Certification	RIP v2	OSPFv2	Virtual Router Redundancy Protocol (VRRP)
3Com® Switch 4800G 24-Port	✓✓	✓✓	✓✓
Cisco Catalyst 6506-E	✓✓	✓✓	✓✓
Enterasys SecureStack A2H124-48	N/A N/A	N/A N/A	N/A N/A
Enterasys SecureStack B3G124-24	✓✓	N/A N/A	N/A N/A
Enterasys SecureStack C2K122-24	✓✓	✓✓	✓✓
Enterasys G3G124-24P w/G3K-4XFP	✓✓	✓✓	✓✓
Enterasys Matrix-N 7G4282-49 w/7K-2XFP	✓✓	✓✓	✓✓
Enterasys Matrix X4 Secure Core Router	✓✓	✓✓	✓✓
Force10 C300 Resilient Switch	N/A N/A	✓✓	✓✓
Nortel 1/10Gb Uplink Ethernet Switch Module for IBM	✓✓	✓✓	✓✓
Foundry FastIron GS 624P-PoE	N/A N/A	N/A N/A	✓✓
Foundry FastIron LS 624	N/A N/A	N/A N/A	✓✓
Foundry FastIron Edge Series X 624E+2XG-PREM6	✓✓	✓✓	✓✓
Foundry BigIron RX-4-AC	✓✓	✓✓	✓✓
HP 1:10Gb Ethernet Blade Switch	✓✓	✓✓	✓✓
HP 10GB Ethernet BL-C switch	✓✓	✓✓	✓✓
NEC 1G Intelligent L3 Switch	✓✓	✓✓	✓✓
NEC 10G Intelligent L3 Switch	✓✓	✓✓	✓✓

PASS

N/A = Feature Not Tested

N/S = Feature Not Supported

✓ NEC 1G Intelligent L3 Switch
✓ NEC 10G Intelligent L3 Switch

Source: The Tolly Group, August 2008

Figure 3

Virtual Router Redundancy Protocol (VRRP)

Devices earning this certification have demonstrated interoperability using VRRP in both Master and backup configurations with all possible vendor combinations. This verifies a device's ability to act as a standby router in the event of failure using VRRP standards in a multivendor network.

For this test, the NEC L3 devices tested achieved interoperability using VRRP with participating switches from 3Com, Enterasys, Cisco, Force10, HP, IBM and Foundry.

For this test, the two NEC switches demonstrated

interoperability using PIM-SM with switches from 3Com, Cisco, Enterasys and Force10.

Test Setup and Methodology

Tolly Group engineers tested three NEC switch models the NEC 1G Intelligent L2 Switch, NEC 1G Intelligent L3 Switch & NEC 10G Intelligent L3 switches.

Full details on the software versions of NEC switches tested, and info on the other 19 switches can be found in Figure 4 on page 6.

The Cisco Catalyst 6506-E switch and associated accessories were provided by Network Hardware, LLC - a leading provider of used, preowned, refurbished equipment from leading vendors like Cisco Systems, Ju-

niper Networks, Extreme Networks, Redback, etc.

Ixia provided valuable facilities and logistics support for the Switches Interoperability Study 2008 Tests. Ixia's new iSim City lab facility in Santa Clara, CA hosted the testing, and provided state-of-the-art power provisioning, management and cooling that were critical to a test of this scale.

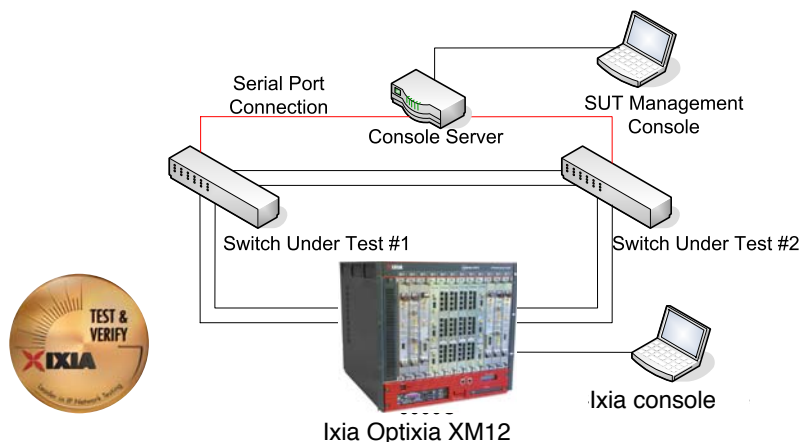
The testbed utilized IxYukon, Ixia's latest solution for testing 10 GbE devices and networks. IxYukon interface modules are used with Ixia's latest XM family of chassis: the XM12 and XM2. IxYukon's high-density packaging provides up to 96 ports of 10GbE in a 10U rack-mount chassis and 16 ports in a portable configuration.

The Tolly Group Switch Interoperability Study 2008 Device Under Test (DUT) Information		
Device Under Test	Software Version	HW Revision (Chassis Revision for Modular Switch)
3Com Switch 4800G 24-Port	5.2	REV. B
Cisco Catalyst 6506-E	12.2	WS-C6506-E
Enterasys SecureStack A2H124-48	A2-Series 02.01.02.0001	N/A
Enterasys Secure Stack B3G124-24	B3-Series 01.01.05.0004	N/A
Enterasys SecureStack C2K122-24	C2-Series 05.01.05.0004	N/A
Enterasys G3G124-24P w/G3K-4XFP	G3-Series 01.00.03.0002	N/A
Enterasys D2G124-12	D2-Series 01.00.01.0005	N/A
Enterasys Matrix N 7G4282-49 w/7K-2XFP	6.01.01.020	N1chassis
Enterasys Matrix X4	1.6.4.P3	N/A
Force10 C300 Resilient Switch	FTOS 7.7.1.0	N/A
IBM Nortel 1/10Gb Uplink Ethernet Switch Module	1.0.1	N/A
HP 1:10Gb Ethernet Blade Switch for C-Class Blade System	1.0.51.0	N/A
HP 10GB Ethernet BL-C Switch	1.0.51.0	N/A
NEC 1G Intelligent L2 Switch	1.2.0.10	N/A
NEC 1G Intelligent L3 Switch	1.1.0.11	N/A
NEC 10G Intelligent L2 Switch	1.0.2.0	N/A
Foundry FastIron GS 624-PoE	4.200a	N/A
Foundry FastIron LS 624	4.2.00b	N/A
Foundry FastIron Edge Series X624E+2XG-PREM6	4.1.00a	N/A
Foundry BigIron RX-4-AC	2.4.Oe	N/A

Source: The Tolly Group, August 2008

Figure 4

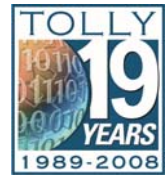
Test Bed Diagram



Source: The Tolly Group, August 2008

Figure 5

The Tolly Group is a leading global provider of third-party validation services for vendors of IT products, components and services.



The company is based in Boca Raton, FL and can be reached at <http://www.tolly.com>, sales@tolly.com or (561) 391-5610

Test Equipment Summary

The Tolly Group gratefully acknowledges the providers of test equipment used in this project.

Vendor	Product	Web
IXIA	Ixia Optixia XM12 chassis with IxYukon 8-port 10GbE module	http://www.ixiacom.com
 NETWORK HARDWARE RESALE	Cisco Catalyst 6506-E	http://www.networkhardware.com

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